LORA BASED RENEWABLE ENERGY MONITORING AND POWER MANAGEMENT SYSTEM USING OPEN IOT PLATFORM

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ABSTRACT: Rapid growth in the usage of renewable resources is increasing day by day in which lot of applications are implemented with significant cost reduction and green go method by eliminating the wastage of energy. In this paper, we perform the operation of monitoring the renewable energy utilization with the implementation method and analysis. In unstable wind power and photovoltaic power generation, a complete analysis and optimal maintenance of operation status through remote monitoring system are required. We make use of various open IoT platforms as Arduino, cost effective LoRa Network and LabVIEW to verify the results. Along with the monitoring system energy management system is also implemented to make use of the monitored renewable energy resources stored in battery which is a subject of great importance and complexity. From the monitored renewable energy distribution of power is done by analyzing the power produced from solar panel and wind energy equally to the loads and a warning system is introduced for over current flow detection. The monitoring system proposed in this paper can be applied to the future energy LoRa system because of the ease of implementation, reduced development cost and variety of applications.

Keywords: Renewable Energy, Power Management, Wind Energy & Solar Panel

1. INTRODUCTION

Humans have forever developed technology to support their desires and needs. The essential need of alteration in technology, regardless of the domain has been to change task and creating everyday chores accessible and quicker. As a result of the response of the COP21, many renewable energy power plants have been introduced as an alternative for the non-renewable energy resources as coal, natural gas, nuclear energy and fossil fuels. The non-renewable resources are not eco-friendly which creates pollution and creates health issues to the employees working in the power plants. The better alternative for non-renewable is the renewable source of energy to avoid the drawbacks. As there are many renewable resources, we utilize the photovoltaic source and wind energy. This also prevents the emission of toxic gases and protects the environment from global warning. An energy monitoring system is built up with the cost-efficient method. The transmission of energy from different renewable resources is transmitted via IoT devices in which implementation cost only is very high and the transmission is also not reliable. Even though the alternatives like Bluetooth modules come into picture again it is limited with the very short range.

2. LITERATURE SURVEY

LoRa based Renewable Energy Monitoring System with Open IoT Platform

Chang-Sic Choi, Jin-Doo Jeong, Il-Woo Lee and Wan-Ki Park worked on a project in which the Renewable energy system is monitored continuously and various applications of LoRa is listed out but it is not with any specific real world application. It doesn't provide any solution to the reality and provided with generalized applications

Wind turbine monitoring and control systems using Internet of Things

D.Kalyanraj, S. LeninPrakash, S. Sabareswa has formulated their proposal in such a way that wind turbines are monitored in very efficient way through which security to the system is provided. But the drawback of the system is cost inefficient as it utilizes Internet of Things as transmission media.

Transient stability studies of power system with shared transmission of wind power and thermal power

Zhongyi Liu, Chongru Liu, Yi Ding, Gengyin Li has introduced the "Transient studies of power system" in which the power system is completely stabilized nut it makes use of only nonrenewable source of energy which creates lot of discomfort.

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3. SYSTEM ANALYSIS
3.1. EXISTING SYSTEM

Nonrenewable resources are existing sources of energy which produces many by products such as toxic gases and pollutes the environment too. As an alternative to the resources such as coal, oil, natural gas and nuclear energy the renewable resources such as solar panel, wind energy and thermal energy is utilized for power generation. It is non-reusable and low power produced and leads to wastage of energy in large amount.

There is no mechanism to continuously monitor the energy produced. In the earlier days the transmission of energy from the wind mills is also done with the IoT or Wi-Fi module which is not reliable and not a cost efficient method. This discrepancy can be eliminated by LoRa based energy monitoring and power management system.

3.2. STASTICAL ANALYSIS

An analysis is done based on the utilization of the non-renewable resources along with their impacts. The nonrenewable resources are encountered and with the factors of cost, initial power, reusability and pollution. A comparison is made with all the listed parameters between the renewable and nonrenewable resources. The cost of the renewable resources will be little high compared to the nonrenewable resources due to initial setup. All the other parameters high impact on renewable resource.

If you look in to the factor such as initial power, pollution and reusability the renewable resources are ecofriendly and does not lead to any loss of energy and it does not require initial power to set up as well. So renewable is most efficient compared to all other resources.
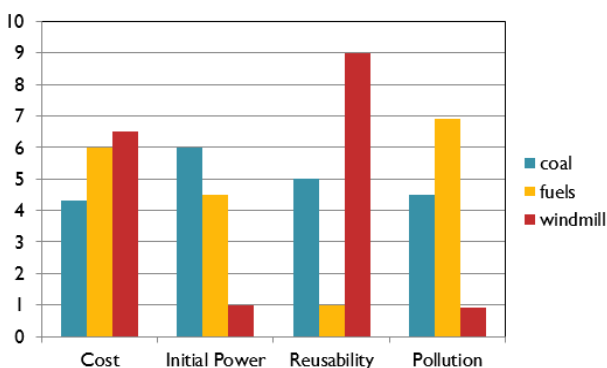

**Figure :1 Stastical Analysis**

3.3. PROPOSED SYSTEM

In this era, the use of nonrenewable resources is increasing day by day and the consumers bother with the intermittent and their impacts. As the need of resources and energy and keeps on mounting up there should be some alternative needed for this nonrenewable source of energy. By overcoming the disadvantages of nonrenewable energy, renewable resources are used to produce energy. But the problem arises with the initial setup cost and maintenance. In our proposed system this disadvantage is manipulated by using LoRa for transmitting and receiving data. LoRa uses bidirectional antenna and it is cost efficient. It covers maximum range that cannot be achieved by any open IoT modules and Wi-Fi. A continuous energy monitoring system is implemented through which any wastage of power can be easily identified. Further a pre indication support power management system is implemented to eliminate overload. The power produced from the renewable resources such as solar panel, windmill and power saved for future purpose saved in battery is viewed through LabVIEW in the excel format. High signal strength can be achieved through SMA antenna since it is a directional antenna.

3.4. BLOCK DIAGRAM
3.4.1 Field station
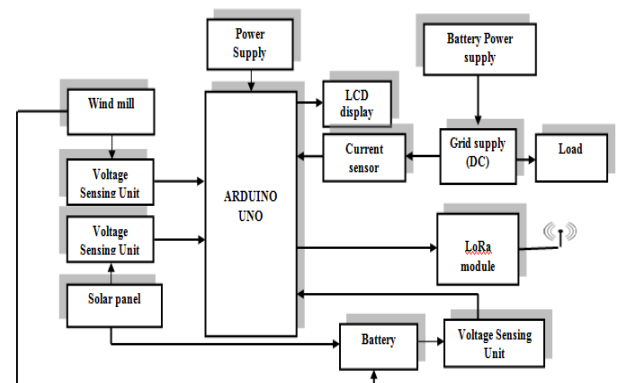
3.4.2 Base station
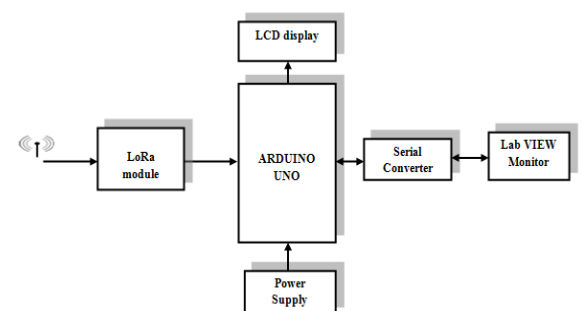
3.5 METHODOLOGY

The complete methodology is defined into two systems as renewable energy monitoring system and power management system.

3.5.1 Renewable Energy Monitoring System

Power is received from the windmill and solar panel which is the renewable source of energy. The obtained power is stored in the chargeable batteries for alter purpose. This obtained voltage is processed by voltage sensing unit and processed by controller. The obtained power from the renewable resources is transmitted through LoRa through the SMA Antenna. The SMA Antenna is the bidirectional antenna. The SMA in the receiver will check for the signal whether it is received or not. Until it receives the signal the system will be idle.

If the signal received at the receiver end the same process happens in the receiver side and the energy produced is monitored continuously. The monitored energy can be viewed through LabVIEW. The detailed explanation of warning signal is done in power management.
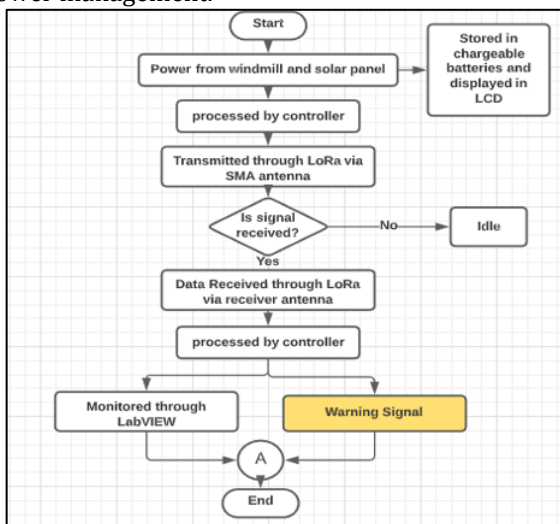

Figure: 3 Renewable Energy Monitoring System

3.5.2 Power Management System

The energy obtained from the renewable resource which is stored in the rechargeable batteries are utilised for power management system. The grid supplies are continuously energised from the battery source. The power will be equally distributed among the different loads. Before supplying to the load the power will be continuously sensed by the current sensor. If it is overloaded the current sensor breaks the circuit and will not allow the power to pass on the loads. When the power from the source is limited within the range it will be passed on to the loads.
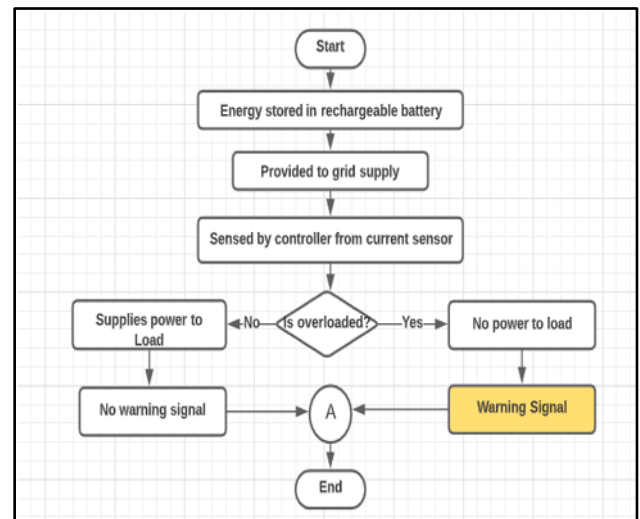

Figure :4 Power Management Systems

4. RESULT

The hardware part of the project is explained here. It consists of Arduino Uno, battery for energy storage, LoRa unit, Relays, SMA Antenna, voltage and current sensor and other supporting components. This represents the field station which is the transmitter side. This represents the base station which acts as receiver side. The LabVIEW results are also added here to continuously record the energy produced from the renewable resources.

5. CONCLUSION

In this paper, we describe the implementation of monitoring system for renewable energy generation facilities with the system architecture, implementation method, and analysis program. We use various open IoT platform such as. This model has presented a pre indication power management system from renewable resources. This model has presented a pre indication power management system from renewable resources. Further it provides continuous renewable energy monitoring system from Remote Site (Solar, Windmill, etc..,) and give the proper information to the respective person without using Bluetooth or Wi-Fi or Internet.

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